

REMARKS

I. Status of the Claims

Claims 1-11 and 19 are pending in this application, and remain for consideration. Claims 12-18 and 20, subject to Examiner's Restriction Requirement, are canceled herein without prejudice as drawn to a non-elected invention. Applicants retain the right to present claims 12-18 and 20 in a divisional application. Claim 1 is amended in this response. Support for this amendment is found in the current application at page 9, line 33 to page 10, line 2. Claim 7 is also amended in this response, as suggested by Examiner's claim objection.

II. Response to the Nonstatutory Obviousness-type Double Patenting Rejection and the Section 103 Rejection

Examiner has rejected claims 1-11 on the ground of nonstatutory obviousness-type double patenting over claims 1-6 of Han et al. (U.S. Pat. No. 7,144,499) in view of Kocal et al. (U.S. Pat. No. 6,368,495), and has also rejected claims 1-11 under 35 U.S.C. § 103(a) as unpatentable over Han in view of Kocal. Applicants traverse these rejections, and they respectfully ask the Examiner to reconsider and withdraw the rejection in view of the following remarks.

Applicants currently claim a process comprising (a) contacting a fuel containing organosulfur impurities with an organic hydroperoxide in the presence of an oxidation catalyst to form an oxidized fuel, wherein a substantial portion of the organosulfur impurities are converted into sulfones and a residual amount of organic hydroperoxide remains in the oxidized fuel; (b) extracting the sulfones from the oxidized fuel to form a fuel having a reduced amount of sulfones and a residual amount of organic hydroperoxide; and (c) contacting the fuel from step (b) with a Group 4 to 11 transition metal-containing decomposition catalyst at a temperature in the range of 20-150°C.

Han teaches a method of purifying fuel streams containing organosulfur impurities. The fuel stream is oxidized with an organic hydroperoxide in the presence of an oxidation catalyst to form a sulfone product. The alcohol product of the organic

hydroperoxide is then removed from the oxidized fuel stream, followed by extraction of the sulfone product by solid-liquid extraction using solid adsorbents.

Han does not teach contacting the fuel (produced after solid-liquid extraction) with a Group 4 to 11 transition metal-containing decomposition catalyst in order to decompose the residual organic hydroperoxides in the fuel stream. Han does not even teach that residual organic hydroperoxides remain in the fuel stream following the oxidation and extraction steps.

Kocal also teaches a process for the removal of organic sulfur compounds from liquid hydrocarbons. The Kocal process first subjects the liquid hydrocarbon to oxidation conditions in order to oxidize at least some of the sulfur compounds to sulfones, and then the sulfones are catalytically decomposed to hydrocarbons and volatile sulfur compounds which are separated by well-known techniques such as flash vaporization or distillation (see the Abstract).

Thus, Han and Kocal both teach an oxidation step that is similar to Applicants' step (a) of contacting a fuel containing organosulfur impurities with an organic hydroperoxide in the presence of an oxidation catalyst to form an oxidized fuel. However, neither Han nor Kocal teach that residual organic hydroperoxides remain in the fuel stream following the oxidation step.

In addition, although Han and Kocal teach that sulfones are produced in the oxidation step, they take two different approaches to remove the sulfones from the fuel stream. Like Applicants' currently claimed process, Han removes the sulfones by an extraction process. However, Kocal teaches an energy-intensive, high temperature catalytic decomposition process to remove the sulfones.

Kocal's catalytic decomposition of the oxidized organic sulfur species is described in detail from Col. 6, l. 6 to Col. 7, l. 36. The Kocal catalytic decomposition is conducted at a high temperature of 200°C to 600°C, preferably from 350°C to 400°C (see Col. 6, l. 40-47). The Kocal catalytic decomposition step utilizes a solid acid or base catalyst, e.g., aluminosilicates such as ZSM-5 and mordenite, metal oxides such as alumina, mixed metal oxides such as $\text{SiO}_2\cdot\text{ZrO}$, and solid bases such as MgO or hydrotalcites (see Col. 6, l. 11-30).

Given that Han and Kocal do not teach the presence of residual hydroperoxides and teach disparate methods of removing sulfones from the fuel stream, one of ordinary skill in the art would have no motivation to combine the teachings of Han and Kocal to develop Applicants' currently claimed process. Since Han teaches that sulfones are removed from the fuel stream using its solid-liquid extraction step, there is no motive for one skilled in the art to then use the Kocal catalytic decomposition step to remove sulfones that have been previously removed by the extraction step.

Even if one of ordinary skill in the art would decide to add the Kocal catalytic decomposition step on top of the Han extraction step, one would have no reasonable expectation that the currently claimed process would be successful. The currently claimed process now requires that the contacting of the fuel from step (b) with a Group 4 to 11 transition metal-containing decomposition catalyst is conducted at a temperature in the range of 20 to 150°C in order to decompose the residual organic hydroperoxides in the fuel stream. However, as discussed above, Kocal teaches that its catalytic decomposition step is effective only at 200°C to 600°C, and preferably from 350°C to 400°C. In fact, the Kocal examples of the invention (Examples 1-4) are performed at a temperature of 425°C or 475°C. Thus, there is nothing in Kocal that would suggest that the low temperature (20 to 150°C) now required by the currently claimed invention would be feasible to decompose sulfones, let alone the residual organic hydroperoxide as taught in the current application.

In sum, the prior art would not have suggested to those of ordinary skill in the art that they should carry out Applicants' claimed process.

In view of the foregoing, Applicants respectfully ask the Examiner to reconsider and withdraw the rejections and pass the case to issue. Applicants invite the Examiner to telephone their attorney at (610) 359-2465 if Examiner believes that a discussion of the application might be helpful.

I hereby certify that this correspondence is being deposited with the United States Postal Service as first-class mail, with sufficient postage, in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on May 25, 2007.

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Respectfully submitted,

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